



Using podcasts to replace lecture: Effects on student achievement

Blanche W. O'Bannon^{a,*}, Jennifer K. Lubke^a, Jeffrey L. Beard^b, Virginia G. Britt^b

^a Department of Theory and Practice in Teacher Education, The University of Tennessee, Knoxville, TN 37996-3442, USA

^b Department of Educational Psychology, The University of Tennessee, Knoxville, TN 37996-3442, USA

ARTICLE INFO

Article history:

Received 14 December 2010

Received in revised form

2 April 2011

Accepted 5 April 2011

Keywords:

21st century skills

Web 2.0

Podcasts

Delivery methods

Teacher education

ABSTRACT

This study examined achievement when podcasts were used in place of lecture in the core technology course required for all students seeking teacher licensure at a large research-intensive university in the Southeastern United States. Further, it examined the listening preferences of the podcast group and the barriers to podcast use. The results revealed that there was no significant difference in the achievement of preservice teachers who experienced podcast instruction versus those who received lecture instruction. Further, there was no significant difference in their study habits. Participants preferred to use a computer and Blackboard for downloading the podcasts, which they primarily listened to at home. They tended to like the podcasts as well as the length of the podcasts and felt that they were reasonably effective for learning. They agreed that the podcasts were easy to use but disagreed that they should be used to replace lecture. Barriers to podcast use include unfamiliarity with podcasts, technical problems in accessing and downloading podcasts, and not seeing the relevance of podcasts to their learning.

© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

New and powerful opportunities for learning are possible in classrooms through the use of Web 2.0 tools. Accessible by anyone with a connection to the Internet and a browser, these free tools allow teachers and students to access and incorporate content on various topics into their coursework. One category of Web 2.0 tools is podcasts. Podcasts, first mentioned by Hammersley (2004), but used sparingly in education until recently, are the topic of this study. This study examined achievement when podcasts were used in place of lecture in the core technology course required for all students seeking teacher licensure at a large research-intensive university in the Southeastern United States. Further, it examined the listening preferences of the podcast group and the barriers to podcast use.

2. Literature review

The term *podcast* is a blend of *pod* from Apple's iPod and *broadcasting*. Podcasts are digital media files distributed through the Internet and downloaded through syndication for playback on a computer or MP3 player. Podcasts may be delivered in audio format only or in enhanced format (audio and video). Video can be in the form of video clips or screencasts "as in capturing what is on the computer screen, adding a bit of audio narrative, and publishing as multimedia" (Richardson, 2006, p. 111). Richardson (2008) explains further that the growth of multimedia on the Web is a result of the rapid expansion of broadband connectivity and cheap computer memory. Udell (as cited in Gribbins, 2007) identifies five reasons that podcasts have experienced explosive growth. These reasons include (1) the pervasive nature of the Internet, (2) the rapid growth of broadband, (3) the creation of multimedia personal computers, which are considered commonplace, (4) the blurring of streaming and downloading media, and (5) the rapid adoption of MP3 devices. Multimedia is far easier to create and consume, expanding ways to communicate with learners.

2.1. Current uses of podcasts in education

During a review of literature that reports the use of audio podcasts in K-12 and higher education, Hew (2009) discovered that individuals (1) use existing podcasts and/or (2) create their own podcasts. Podcasts are created by students for projects or by instructors for

* Corresponding author. 445 Claxton Complex, The University of Tennessee, Knoxville, TN 37996-3442, USA. Tel.: +1 865 974 0498; fax: +1 865 974 6302.
E-mail address: bobannon@utk.edu (B.W. O'Bannon).

instructional purposes. Hew reports that instructors use podcasts in one of three ways in academic settings. In the first approach, the podcast is used to duplicate the classroom lecture. Typically, the student attends the lecture and uses the podcast as a backup for reviewing complex topics. Deal (2007) concludes that this is not only the most predictable use; it is also the most requested by students and is the easiest to implement. However, Lane (as cited in Hew, 2009) stresses that the most common complaint about using lectures in podcasts is the absence of student questioning or discussion.

In the second approach, the podcast is used to share additional information with the student; it is supplemental in nature. The third approach involves using the podcast to introduce or prepare the learner for new information that will be covered during the subsequent class period(s).

2.2. Benefits of podcasting

A growing number of educators consider podcasting to be a dynamic paradigm of pedagogical potential that is capable of improving teaching and learning in classrooms (Brittain, Glowacki, Van Ittersum, & Johnson, 2006; Campbell, 2005; Cebeci & Tekdal, 2006; Dale, 2007; Richardson, 2008; Soloman & Schrum, 2007). Since 2004, authors have conducted research to determine the benefits associated with using podcasts in education. Duke University was at the forefront of this research. In 2004, Duke, in collaboration with Apple Computer, provided 1600 iPods to incoming freshman and studied the feasibility and effectiveness of the iPod as a tool for academic use by students and faculty over the course of two semesters. Findings revealed increased convenience for both students and faculty; reduced dependence on labs and library; greater student engagement and interest in classroom discussions, labs, field research, and projects; and improved support of individual learning preferences (Berlanger, 2005).

There are additional documented benefits of using podcasts in learning. Hew (2009) concludes, “Probably the main advantage of podcasting is the simplicity, convenience, and time savings that it offers to learners” (p. 334). Authors Boulos, Maramba, and Wheeler (2006), Gribbins (2007), and Hollandsworth (2007) agree that the ease of use of podcasts is a huge advantage to the learning process. Podcasts are considered to be a flexible learning tool that can be used anytime and anywhere (Berlanger, 2005; Evans, 2008; Fernandez, Simo, & Sallan, 2009; Vogt, Scaffner, Ribar, & Chavez, 2010), giving students control over aspects of their own learning in terms of time and place (Clark & Walsh, 2004; Evans, 2008; Hollandsworth, 2007; Shim, Shropshire, Park, Harris, & Campbell, 2006) and can be listened to repeatedly (Berlanger, 2005; DeVoe, 2006; McKinney, Dyck, & Luber, 2009). Mobile technologies, including MP3 players, smartphones, and Personal Digital Assistants (PDAs), extend this flexibility and allow learners to review instructional information while on the move (e.g., on the bus, on the train, or in the car).

Boulos et al. (2006), Honey and Mumford (2006), and Ralph and Olsen (2007) assert that podcasts give superior support to auditory learners who comprise 30% of all learners. Additionally, the number of learners who can be accommodated increases greatly when podcasts are enhanced through audio and video. Berlanger (2005) reports that students who enrolled in courses with listening comprehension requirements, such as foreign language and music, reported that podcasts were extremely valuable. Moreover, students reported that replaying podcasts facilitated the comprehension of complex concepts and increased understanding for non-native language learners.

2.3. Challenges of podcasting

The pedagogical challenges associated with podcasts should be taken into consideration when planning instruction. The Duke project (Berlanger, 2005) encountered challenges with the use of iPods for academic purposes; however, the passage of time and continued development of and comfort with the tool by the Millennium Generation and the birth of iTunes have relieved some of those challenges. These challenges include the integration of systems for content storage, access, sharing, and distribution; limitations of the device; and difficulties in finding commercial sources as well as the lack of bulk purchasing for MP3 audio content for academic use. Additional challenges reported by the Duke participants were lack of awareness or accurate knowledge of iPod functionality and academic applications, lack of quality recordings, and limited documentation and training resources.

A number of additional studies have examined the challenges of using podcasts. Student-encountered challenges include unfamiliarity with podcasts, technical problems associated with accessing and downloading podcasts, and not seeing the relevance of the podcast to their learning (Bell, Cockburn, Wingkvist, & Green, 2007; Edirisingha & Salmon, 2007; Lane, 2006; Ogawa & Nickels, 2006; Tynan & Colbran, 2006). Hollandsworth (2007) studied the use of podcasts in online business courses and found that clear instructions for downloading from iTunes and subscribing to a feed lessened student anxiety. He suggests further that hardware costs are transferred to students and that learning is dependent on the students' interest in and acceptance of using these forms of technology. Maag (2006) adds that students must adopt the device as one that can be used in education. Furthermore, audio and video files can be large in size, and users must have sufficient bandwidth to download files (Boulos et al., 2006).

3. Theoretical underpinnings

Our study of the use of visually enhanced podcasts is informed by theories on auditory and multimedia learning as well as Connectivism, a theory that describes how people connect and learn in the digital age. Barron (2004) summarizes a century of research on the use of emergent audio technologies, and most of these studies reveal “no significant differences” between instructional modes, enabling educators to confidently integrate new tools (p. 955). Yet, while implications for the science of instruction are clear, implications for the science of learning and human cognition remain less clear. Research indicates a “modality effect” for human memory in which audio information is processed differently and is recalled more easily than the same information presented visually. Thus, a large body of conflicting theoretical work has emerged. Barron notes that, “Although the controversy over multichannel processing of information is not over, guidelines are beginning to emerge” (p. 962).

Chief among those guidelines is Mayer's (1997, p. 4) “generative theory of multimedia learning,” which positions the learner as “a knowledge constructor who actively selects and connects pieces of visual and verbal knowledge”. Based on a guiding thesis that people learn better from a combination of words (written or spoken) and pictures, multimedia learning theory incorporates basic assumptions

within the science of cognition, namely that the brain is dual-channeled and of limited capacity and that humans are active agents in the construction of knowledge (Mayer, 2009). Moreover, Mayer (1997, p.8) recommends the focus be shifted away from systems of delivery to “more productive questions” about the role of multimedia in facilitating instruction and meeting the needs of learners.

Mayer first asserted his notions about effective use of multimedia content well ahead of the 21st century explosion in digital and web-based tools, such as podcasts. A theory that makes accommodation for the new ways people connect and learn in the digital age is Connectivism, proposed by Siemens (2004). Siemens suggests that in the last two decades, technology has restructured how we live, communicate, and learn. He says further that learning is based on experiences and because first-hand experience is not always feasible, competence is gained from forming connections and sharing the experiences of others. In an August 2010 interview (Hargadon, 2010), Siemens highlights the educational reform aspects of 21st century digital technologies and encourages educators to ask themselves, “What is it that we can now do better with technology that we couldn't do a generation ago?” Siemens argues against lecture, stating that free and open technology resources now enable educators to record, broadcast, and archive essential course content. He envisions a “dramatic restructuring of education” that enables more one-to-one interactions with students. This is the “challenge” put forth by Soloman and Schrum (2007) who recommend blending new technologies with student-centered pedagogy “to support in-depth learning and increased student achievement” (p. 41).

4. Purpose of the study

Within the current research context, each student who seeks teacher licensure at this university is required to enroll in a technology course as a part of professional coursework. Direct instruction (lecture), accompanied by multimedia slideshows, is used to deliver fundamental information from each chapter in the course textbook. This is followed by demonstration, hands-on guided practice, and project-based development. Instructors' observations reveal that students grow progressively restless during periods of direct instruction. In addition, it consumes valuable time needed for hands-on practice and project design. Nevertheless, the information provided is essential to student learning because it contains the theory base, research findings, and best practices for the classroom.

Previous research indicates that there are documented benefits to using podcasts in learning. One in particular is that students are more receptive to learning material provided in podcast form versus textbook and traditional lecture form (Evans, 2008). However, others note a paucity of documentation of the academic benefits of instructional podcasts (Heilesen, 2010; Lazzari, 2009). Lazzari notes “there is a lack of studies on the effect of podcasting on learning” (p. 28). Our intention is to contribute information to the literature in this area.

Lonn and Teasley (2009) suggests that podcasting offers instructors the ability to “capture fundamental topics for review while devoting face-to-face time for more discussion, student-led instruction, and other innovative activities” (p. 92). Using podcasts to deliver the information covered in direct instruction seems valuable; the extra time gained in class allows for longer periods of hands-on practice and student-centered interactions between learners and peers and learners and instructor, thus building digital literacy among preservice teachers. Consequently, the purpose of this study was to examine the effects of podcasts on achievement when used to replace lecture. The study also examined the listening preferences of the podcast group as well as the barriers to podcast use.

5. Methodology

5.1. Context of the study

The teacher education program within the College of Education, Health, and Human Sciences (CEHHS) at this university graduates approximately 400 new teachers each year. These graduates, products of a 5-year teacher preparation program, spend the first 3 years of their study in the College of Arts and Sciences. During the third year of coursework, they make formal application to a specific teacher licensure program. If accepted, they complete departmental/college coursework during the fourth year. This coursework includes three core courses as well as methods classes. Requirements for a teaching license are completed during a full-year internship in the public schools during the fifth year.

One core course is a technology class focused on integration of technology into the K-12 curriculum (see <https://sites.google.com/site/technology486/>). Fourteen sections of the technology course are offered annually and serve roughly 275 students. All sections are held in a lab setting, are capped at 20 students, and are taught by a team of instructors who follow a universal syllabus, textbook, and course materials packet to ensure consistent alignment with the National Educational Technology Standards for Teachers (NETS-T). An online course management tool provides a digital drop box, discussion board, electronic assessments, and links to course resources. The course design emphasizes hands-on development of technology-enhanced lessons and activities for use by preservice teachers during their internships and later professional practices.

5.2. Participants

Seventy-eight students who were enrolled in four sections of the technology course in the Spring 2010 semester were invited to participate in the study. Of these students, 69 (88%) completed the study. The average age of the participants was 23. Fifty-eight (84%) of the participants were female, and 11 (16%) were male.

The four sections were randomly assigned to the podcast group (PG) or the control group (CG). Within the podcast group, 36 (90%) of the students who were enrolled accepted the invitation to participate in the study. Thirty-four (94%) were female, and two (6%) were male. The average age of participants in the podcast group was 23.5. Within the control group, 33 (87%) of the students enrolled agreed to participate. Twenty-four (73%) students were female, and nine (27%) were male. The average age of participants in the control group was 22.6. Table 1 shows the distribution of participants among licensure areas.

Table 1
Participant licensure areas.

	Podcast Group N = 36(1.00)	Control Group N = 33(1.00)	Total N = 69(1.00)
License Sought			
Early Childhood (PK–3)	8(.21)	1(.03)	9(.13)
Elementary Ed (1–6)	5(.13)	5(.14)	10(.15)
Middle Schools (4–8)	2(.05)	1(.03)	2(.03)
Art (K–12)	3(.08)	0(.00)	3(.04)
Music (K–12)	3(.08)	0(.00)	3(.04)
Deaf Ed (K–12)	1(.03)	2(.06)	3(.04)
Special Ed (K–12)	3(.08)	2(.06)	6(.09)
English (7–12)	5(.13)	3(.09)	8(.12)
Math (7–12)	2(.05)	4(.11)	6(.09)
Science (7–12)	1(.03)	3(.09)	4(.06)
Social Studies (7–12)	3(.08)	7(.20)	10(.15)
Foreign Languages (7–12)	0(.00)	5(.14)	5(.07)

5.3. Data sources

Chapter quiz scores, online survey responses, and podcast journals were the data sources used in this study. The quiz scores were used to answer the first research question. Each chapter quiz consisted of 15 multiple-choice questions that were developed by the textbook authors, one of whom is the first author of this study. Each chapter quiz was administered at the completion of chapter study through the assessment feature in Blackboard. The survey and podcast journals were used to answer the second and third research questions. The survey, consisting of 14 items and developed by the first author, was used to gather demographic data as well as data regarding computer expertise, preferences for using technology in college coursework, MP3 ownership, prior experiences with podcasts including the format of those podcasts, and study habits in the course. The PG received 27 additional questions to determine how and where they accessed the podcasts, the number of times they accessed the podcasts, and any difficulty they experienced with access. Further, the PG was asked to indicate their preferences for using podcasts to replace lecture and to provide suggestions for improving the podcasts.

The survey contained a mix of question types including single answer and Likert-scaled questions using 4- and 5-point scales. A 4-point Likert scale (Always, Sometimes, Seldom, and Never) was used to determine study habits, and Likert-scaled questions using a 5-point scale (0, 1, 2, 3, and more than 3) were used to determine the frequency that participants listened to each podcast. Likert-scaled questions using a 5-point scale (SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, and SA = Strongly Agree) were used to determine student preferences for podcasts. The third data source was a log given to the PG for recording the number of times they accessed the podcasts as well as the location where the access took place. This log enhanced the participants' memory of their experiences.

5.4. Procedures

5.4.1. Instructional sequence

Students were directed to (1) read each chapter in the textbook, (2) listen to corresponding podcast episode(s) or class lectures while taking notes on the slideshow handouts, (3) watch instructor demonstration(s), (4) participate in hands-on guided practice, and (5) develop project related materials. At the conclusion of the project development period, the chapter quiz was administered online, and the results were recorded in Blackboard.

5.4.2. Creating and publishing the podcasts

We created a total of 18 podcasts for use in the course; 12 were used in the study. These podcasts varied from the approaches exposed by Hew (2009) and discussed earlier in this paper. Instructor-created enhanced podcasts, based on slideshow content used previously in course lectures, were provided to students prior to class sessions. In accordance with Lazzari and Betella's (2007) recommendations for "development of a podcast of quality" (p. 409), the users, the task, and the context of use were taken into consideration to ensure consistent production values throughout the development process. First, we experimented with different recording locations and equipment to determine which yielded the highest sound quality. In addition to "quality of the production environment," we also made careful accommodation toward maintaining quality of "content and communication style" (Lazzari & Betella, 2007, pp. 409–410). We referred to the literature on optimal podcast length (Anzai, 2007; Chan & Lee, 2005; Lazzari & Betella, 2007; Muppala & Kong, 2007), and because these studies yielded mixed results with ranges reported from 5 to 20 min, we decided to aim for 10-min durations. This required breaking some complex chapters into episodes of two or more. Table 2 presents each chapter concept, episode, and duration used in the study.

Then to support delivery of a coherent and articulate narrative, we composed scripts and/or heavy notes, and these were recorded with Audacity, a free audio editing software. Next, we combined the visuals and the accompanying audio using iMovie, and we added royalty-free music clips to enhance the beginning and ending of each podcast. Finally, in consideration of various users' downloading preferences, we published the podcasts in formats suitable for portable devices (.m4v) and computers (.mov), and these were uploaded to the course sites on iTunesU and Blackboard (the course management tool). We viewed and listened to the podcasts on various devices (e.g., PC, Mac, and portable devices) to verify usability and quality and re-edited for audio and video quality as needed.

5.4.3. Training provisions

Step-by-step directions were developed to guide students during the download of the podcasts from iTunesU and/or Blackboard. With directions in hand, students were provided in-class demonstration and hands-on practice of the download process from iTunesU and

Table 2

Chapter/concept and podcast episodes/duration used in study.

Chapter/Concept	Episodes/Duration
1: Preparing to Use Technology	Introduction to technology integration; ISTE; National Technology Standards for teachers and students (7:30); Planning to use technology; lesson planning (9:00); Transforming learning environments; working with special learners and managing the classroom when using technology (7:00)
2: Portfolios	Introduction to portfolios; Uses; Types (13:00)
3: The Internet	Ways to use the Internet in the classroom; Evaluation of web resources (9:00); Web 2.0 tools and how they benefit learning (8:00); WebQuest model of inquiry based learning (4:00)
4: Digital Images	Introduction to digital images, their use in education and function in a classroom. (7:00); Ways to obtain digital images (11:00); Resolution and its importance to print and electronic documents (7:30)
5: Diagrams	Introduction to digital diagrams, types and their uses in learning. (13:00)
6: Spreadsheets	Introduction to spreadsheets, ways to use in learning. Introduces the creation of interactive spreadsheets to use for student practice or assessment. (8:00)

Blackboard. Students were cautioned about the large size of the podcast files and instructed to use only computers with high speed connections to minimize download time.

5.4.4. Equipment provisions

To accommodate participants who did not have equipment, five iPod Touch devices were provided for checkout in a college “instructional services” facility. Records indicate that the iPods were neither checked out nor used in the facility during the semester.

5.5. Data collection and analysis

Information sheets and consent forms regarding the study were distributed at the beginning of the semester by a researcher who did not serve as an instructor. The consent forms were collected and secured. Instructors were unaware of the identity of the students who agreed/disagreed to participate. Instructors taught all students in their prospective course sections using the same methods, regardless of the students' decisions to participate in the study. At the end of the semester, the preservice teachers who agreed to participate in the study were asked to complete the survey using an online assessment tool. All participants completed questions 1–14. In addition, the PG completed questions 15–43. The constant comparative method (Glaser & Strauss, 1967) was used to analyze data and develop prominent themes. Each researcher analyzed the responses to the open-ended question regarding suggestions for improving the podcasts and noted emergent themes. A meeting was held to compare individual findings and form consensus among the researchers.

Preservice teachers who participated in the study became eligible for a random drawing to win an iPod. Additionally, their names were included in random drawings for iTunes cards. One \$15 iTunes card was awarded in each of the five sections of the course.

6. Results

6.1. Computer expertise and prior experience using podcasts

All of the participants were asked to rate their computer expertise using a scale of 1–5 (1 = beginner; 5 = advanced). The mean was 3.17, SD .766. Most (61, or 88.4%) of the participants confirmed that they owned an MP3 player. Further, more than half (37, or 53.6%) reported owning players with video capability. They estimated that their use of an MP3 player averaged less than 2 h per day. Participants were asked about their prior experiences using podcasts. Over half (39, or 56%) of the participants responded that they had listened to/viewed a podcast prior to participating in the study. Yet, only eight reported that they had listened to or viewed a podcast of a classroom lecture. Of those podcasts, two were audio only, three were slideshows with narration, and three were video recordings.

6.2. Effect on achievement

The first research question examined the effect on achievement in the technology class using podcast instruction versus lecture instruction. The means of the chapter quiz scores for the CG and the PG were calculated and are presented in Table 3. A t-test was administered and the results were $t = -2.960$, $df = 67$, $p = .004$ indicating that there is no significant difference in achievement of the two groups at .05.

Table 3

Group statistics on course quizzes.

	Group	N	Mean	Std. Deviation	Std. Error Mean
Quizzes	Lecture	33	85.72	5.19	.90
	Podcast	36	89.23	4.64	.77

6.3. Listening preferences

The second research question examined the listening preferences of the podcast group. Participants were asked how they downloaded the podcasts. Findings revealed that they used both Blackboard and iTunesU for downloading. Over half (22 or 61%) downloaded the podcasts from Blackboard only; eight (22%) downloaded the podcasts from iTunesU only. Six (17%) of the participants used both Blackboard and iTunes to download the podcasts. Of the six participants, five (83%) reported that their preferred method for downloading was Blackboard. When asked to report the type of hardware they used to access the podcasts, analysis showed that almost all (35, or 97%) used a computer. While the podcasts were accessed from home, the library, and the computer lab, most (33, or 92%) participants reported that they typically accessed the podcasts from home. No one reported accessing them while on the go.

6.4. Listening frequency

PG participants reported the number of times (0, 1, 2, 3, or more than 3) that they listened to each podcast episode (see Table 4). Twenty four (67%) of the participants reported that they listened to most podcasts, yet the number of students who did not listen increased as the semester progressed, with at least 30% not listening to the last three episodes. Only two students listened three times to any one episode.

6.5. Barriers to use

The third research question examined the barriers to podcast use that the PG experienced. As revealed by previous authors (Bell et al., 2007; Edirisingha & Salmon, 2007; Lane, 2006; Ogawa & Nickels, 2006; Tynan & Colbran, 2006), student-encountered barriers in this study included unfamiliarity with podcasts, technical problems in accessing and downloading podcasts, and not seeing the relevance of the podcasts to their learning.

6.5.1. Unfamiliarity with podcasts

Many of the PG were not familiar with podcasts. Almost half (17 or 47.2%) of the PG group had not listened to or viewed a podcast prior to the course. Of those who had, only four had listened to a lecture podcast. Several students made comments about the lack of interactivity in the podcasts. These comments revealed that some participants did not clearly understand the limitations of podcasts. One student said, "Make them more interactive than just reading the slides", while another added, "Links to movies or YouTube videos that were used in the classroom [should be included in the podcasts]".

6.5.2. Technical problems in accessing and downloading podcasts

PG participants reported technical problems in accessing and downloading the podcasts. One third (12, or 33%) of the participants reported experiencing trouble when accessing the podcasts especially from home computers. Comments included, "They did not always work at my home. However, they did work in the computer lab" and "My home PC would not download them. However, I was able to [download] on my Mac Book". In addition, eight (22%) of the PG members reported that some podcasts failed to load or were slow to load. Comments included, "Sometimes they would not load or they were very slow and took a long time to download," "Took a long time to download or didn't at all" and "Just couldn't open it once. I logged out and tried again and it worked! No big deal!"

6.5.3. Not seeing the relevance of the podcast to their learning

To maintain the integrity and purpose of the study, which was to measure the impact of podcasts in lieu of lecture, the podcasters were careful not to deviate from the text on the PowerPoint slides, which were the same slides used to support face-to-face lecture. The podcasters' restraint in interpreting and elaborating on the text generated a negative reaction among a number of the PG participants, who complained that the podcasters read the information and did not include enough elaboration or examples to be relevant to their learning. One remarked,

Make them [the podcasts] more interactive [rather] than just reading the slides. Most of us will read the slides in the materials packet rather than taking the time to pull up iTunesU UNLESS there is more useful information that can be retained from the podcasts.

Table 4
Frequency of listening to podcast episodes.

I listened to:	0		1		2		3		More than 3	
	Count	%	Count	%	Count	%	Count	%	Count	%
Portfolios ____ times?	3	8.33%	21	58.33%	11	30.56%	1	2.78%	0	.00%
Internet :Intro ____ times?	3	8.33%	29	80.56%	4	11.11%	0	.00%	0	.00%
Internet :Web 2.0 ____ times?	5	13.89%	23	63.89%	7	19.44%	1	2.78%	0	.00%
Internet : WebQuest ____ times?	7	19.44%	22	61.11%	7	19.44%	0	.00%	0	.00%
Preparing: Intro ____ times?	7	19.44%	23	63.89%	6	16.67%	0	.00%	0	.00%
Preparing: Planning ____ times?	9	25.00%	21	58.33%	6	16.67%	0	.00%	0	.00%
Preparing: Managing ____ times?	9	25.00%	21	58.33%	6	16.67%	0	.00%	0	.00%
Digital Images: Intro ____ times?	10	27.78%	22	61.11%	4	11.11%	0	.00%	0	.00%
Digital Images: Obtaining ____ times?	9	25.00%	23	63.89%	4	11.11%	0	.00%	0	.00%
Digital Images: Resolution ____ times?	11	30.56%	21	58.33%	4	11.11%	0	.00%	0	.00%
Digital Diagrams ____ times?	12	33.33%	18	50.00%	6	16.67%	0	.00%	0	.00%
Spreadsheets ____ times?	11	30.56%	22	61.11%	3	8.33%	0	.00%	0	.00%

Another said, “The podcaster read the material to us that was already in the book. I can read on my own. These were kind of a waste of time for anything other than review.” Another stated, “Many of the podcasts simply read the lecture PowerPoint notes and didn’t really elaborate. If the podcasts perhaps went more in depth about the topic being covered, I would have found them more helpful.” Another commented, “I believe that if they [the podcasts] are going to take place of class lectures, more information should be given than what is in the slideshow,” and another remarked,

The only thing that bothered me about the podcasts was that for the most part, the podcast said everything that was on the accompanying handout. There was really no elaboration. I think some diversity between the two would be good.

Still another advised, “Add a few more examples instead of just reading them [slides],” while yet another said,

I stopped viewing the podcasts after a few weeks. I found that briefly reviewing the chapter in the textbook was an easier and more efficient way to prepare for class/quizzes, for me personally. I think the podcast is a nice option for people that like it, but I didn’t find them all that helpful or necessary.

One student asserted, “The podcasts were slow and tedious. I stopped listening to them, and I still feel as if the book and class time were enough,” while yet another added, “I am a traditional type student. I enjoy lecture. Podcasts wouldn’t work for me; reading from a computer is difficult for me to retain information. I believe it would be the same for podcasts”.

7. Discussion, implications, and limitations

This study examined the effect on achievement when podcasts were used in lieu of lecture in a core technology course taken by preservice teachers. Further, it examined the listening preferences of the podcast group as well as barriers to podcast use. While [Lazarri \(2009\)](#) found that lecture podcasts had a positive impact on student learning, he stresses that there is a lack of studies on the effect of podcasting on learning. This study provides insight for educators using podcasts in learning as well as in future research efforts.

There was no significant difference in the achievement of students who received podcast instruction versus those who received lecture instruction. This is a major finding and suggests that podcasts can be used in a technology course to disseminate fundamental information and allow more time for demonstration, hands-on practice, and development of technology rich lessons. While most of the participants owned an MP3 player, they used computers rather than mobile devices to access podcasts. This finding supports previous research ([Abt & Barry, 2007](#); [Bell et al., 2007](#); [Brittain et al., 2006](#)) confirming that mobility is not the primary reason to use the format. Further, they accessed the podcasts through Blackboard and at home. In consonance with [Lee and Chan \(2007\)](#), we believe that this suggests that those who argue that instructional podcasting promotes multitasking in students use impressions rather than empirical evidence. In addition, it appears that while the participants use mobile devices for listening to music, they are not yet willing to adopt them for instructional purposes—an essential condition suggested by [Maag \(2006\)](#). Another major finding of the study is that although students found the podcasts easy to use and their use was not detrimental to their achievement, they were not comfortable using podcasts to replace lecture and suggested that they be used for supplemental purposes only.

As reported by previous authors ([Bell et al., 2007](#); [Edirisingha & Salmon, 2007](#); [Lane, 2006](#); [Ogawa & Nickels, 2006](#); [Tynan & Colbran, 2006](#)), student-encountered barriers in this study included unfamiliarity with podcasts, technical problems in accessing and downloading podcasts, and not seeing the relevance of the podcast to their learning. Since these continue to surface in a number of studies, researchers should address ways to overcome these barriers in future studies. The unfamiliarity with podcasts will decrease as time passes, because this remains a new instructional strategy. Researchers should include podcasts within their curriculum to decrease this lack of familiarity.

The results of the study may be influenced by the limitations. The participants in this study were enrolled in a required technology course in education and, thus, were a convenience sample. Because this research was limited to students in a higher education setting, the findings do not give attention to K-12 contexts. In addition, the study was limited in duration to one semester. Studies of short duration may suffer from the novelty effect, the tendency for individuals to initially increase their performance when new technology is involved because of increased interest in the new technology.

8. Conclusions and recommendations

The current study suggests that podcasts can replace lecture with no detrimental effects on achievement in a technology core course taken by preservice teachers. A major benefit of using the podcasts to replace classroom lecture is the additional time gained for in-class demonstration, guided practice, and hands-on development of lesson activities and projects. Once the podcasts are created and archived, the instructor is free to devote instructional time to more student-centered interactions. In this study, a number of students failed to listen to the last three podcasts, yet they achieved high quiz scores. Did the increased instructor–student interaction influence achievement? Additional research should be conducted to determine how participant learning is influenced in the absence of lecture.

The method for creating the enhanced podcasts in this study requires more than basic technology skills, and instructors must weigh the time and resource commitments as well as the technical skill required. Further, the content in a technology course changes much more rapidly than the content in other disciplines; thus, the length of time between creation and revision should be considered.

Because the use of instructional podcasting is in its infancy, there is a need for additional research in different content areas and for longer periods of time. Students must be comfortable with the downloading procedures and accept podcasting as an instructional method. To facilitate this comfort level, instructors should frequently include podcasts in their instructional practices. In addition, students should be provided with explicit instructions on how to access and utilize the podcasts. Methods for ensuring the quality of podcast recordings should be followed by researchers who wish to create more user-centered podcasts. Future research should also address the effect that student-created podcasts have on achievement.

Acknowledgment

The authors wish to thank *Innovative Technology Consulting* (ITC) at the University of Tennessee for funding of this study as part of the 2010 Project RITE (Research of Instructional Technology in Education) Awards.

References

- Abt, G., & Barry, T. (2007). The quantitative effect of students using podcasts in a first year undergraduate exercise physiology module. *Bioscience Education e-Journal*, doi:10.3108/beej.10.8.
- Anzai, Y. (2007). Podcasting and Japanese millennials. In T. Bastiaens, & S. Carliner (Eds.), *Proceedings of world conference on E-Learning in corporate, government, healthcare, and higher education 2007* (pp. 16–23). Chesapeake, VA: AACE.
- Barron, A. E. (2004). Auditory instruction. In D. Jonassen (Ed.), *Handbook of research on educational communications and technology* (pp. 949–978). Mahwah, NJ: Lawrence Erlbaum.
- Bell, T., Cockburn, A., Wingkvist, A., & Green, R. (2007). Podcasts as a supplement in tertiary education: an experiment with two computer science courses. In *Paper presented at the mobile learning technologies and applications conference*. (Auckland, New Zealand).
- Berlanger, Y. (2005). *Duke university iPod first year experience final evaluation*. Retrieved from http://cit.duke.edu/pdf/reports/ipod_initiative_04_05.pdf.
- Boulos, M., Maramba, I., & Wheeler, S. (2006). Wikis, blogs and podcasts: a new generation of web-based tools for virtual collaborative clinical practice and education. *BMC Medical Education*, 6(41)doi:10.1186/1472-6920-6-41.
- Brittain, S., Glowacki, P., Van Ittersum, J., & Johnson, L. (2006). Podcasting lectures. *Educause Quarterly*, 3, 24–31.
- Campbell, G. (2005). There's something in the air: podcasting in education. *EDUCAUSE Review*, 40(6), 32–47.
- Cebeci, Z., & Tekdal, M. (2006). Using podcasts as audio learning objects. *Interdisciplinary Journal of Knowledge and Learning Objects*, 2, 7–57.
- Chan, A., & Lee, Mark. J. W. (2005). An MP3 a day keeps the worries away: exploring the use of podcasting to address preconceptions and alleviate pre-class anxiety amongst undergraduate information technology students. In D. Spennemann, & L. Burr (Eds.), *Good practice in practice. Proceedings of the student experience conference 5–7th september '05* (pp. 59–71). Wagga Wagga, NSW: Charles Sturt University.
- Clark, D., & Walsh, S. (2004). *iPod-learning. [White paper]*. Brighton, UK: Epic Group.
- Dale, C. (2007). Strategies for using podcasting to support student learning. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 6(1), 49–57.
- Deal, A. (2007). *Podcasting. Internal reports and documents*. Retrieved from Pittsburgh, PA: Carnegie Mellon University. <http://www.cmu.edu/teaching/resources/PublicationsArchives/reports-pubs.html>.
- DeVoe, K. (2006). Innovations affecting us: podcasting, coursecasting and the library. *Against the Grain*, 18(1), 78–85.
- Edirisingha, P., & Salmon, G. (2007, May). Pedagogical models for podcasts in higher education. Leicester, UK. Retrieved from *Paper presented at the beyond distance research alliance conference*. <https://ira.le.ac.uk/handle/2381/405>.
- Evans, C. (2008). The effectiveness of m-learning in the form of podcast revision lectures in higher education. *Computers and Education*, 50(4), 491–498doi:10.1016/j.compedu.2007.09.016.
- Fernandez, V., Simo, P., & Sallan, J. (2009). Podcasting: a new technological tool to facilitate good practice in higher education. *Computers and Education*, 53, 385–392doi:10.1016/j.compedu.2009.02.014.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory*. Chicago, IL: Aldine.
- Gribbins, M. (2007). The perceived usefulness of podcasting in higher education: a survey of students' attitudes and intention to use. In *Proceedings of the 2nd Midwest association for information systems conference (Paper 6)*. Springfield, Illinois.
- Hammersley, B. (2004, February 12). Audible revolution. *The Guardian Newspaper*, 27. Retrieved from <http://www.guardian.co.uk/media/2004/feb/12/broadcasting.digitalmedia>.
- Hargadon, S. (2010, August 26). George Siemens on “connectivism” and more. *Future of Education Interview Series*, Retrieved from <http://audio.edtechlive.com/foe/georgesiemens.mp3>.
- Heilesen, S. B. (2010). What is the academic efficacy of podcasting? *Computers & Education*, 55(3), 1063–1068.
- Hew, K. F. (2009). Use of audio podcast in K-12 and higher education: a review of research topics and methodologies. *Education Technology Research and Development*, 57, 333–357doi:10.1007/s11423-008-9108-3.
- Hollandsworth, R. J. (2007). Managing the podcast lecture: a hybrid approach for online lectures in the business classroom. *TechTrends*, 51(4), 39–44.
- Honey, P., & Mumford, A. (2006). *The learning styles helper's guide*. Maidenhead, UK: Peter Honey.
- Lane, C. (2006). *Podcasting at the UW: An evaluation of current use*. Seattle, WA: University of Washington, Office of Learning Technologies.
- Lazzari, M. (2009). Creative use of podcasting in higher education and its effect on competitive agency. *Computers & Education*, 52, 27–34doi:10.1016/j.compedu.2008.06.002.
- Lazzari, M., & Betella, A. (2007). Towards guidelines on educational podcasting quality. In M. Smith, & G. Salvendy (Eds.), *Part II, HCI2007, LNCS 4558* (pp. 404–412) doi:10.1007/978-3-54073354-6_44.
- Lee, M., & Chan, A. (2007). Pervasive, lifestyle-integrated mobile learning for distance learners: an analysis and unexpected results from a podcasting study. *Open learning. The Journal of Open and Distance Learning*, 22(3), 201–218.
- Lonn, S., & Teasley, S. (2009). Podcasting in higher education: what are the implications for teaching and learning? *Internet and Higher Education*, 12, 88–92doi:10.1016/j.iheduc.2009.06.002.
- Maag, M. (2006). Podcasting and MP3 players: emerging education technologies. *CIN: Computers, Informatics, Nursing*, 24(1), 9–13.
- Mayer, R. E. (1997). Multimedia learning: are we asking the right questions? *Educational Psychologist*, 32(1), 1–19.
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge, MA: Cambridge University Press.
- McKinney, D., Dyck, J., & Lubner, E. (2009). iTunes university and the classroom: can podcasts replace professors? *Computers & Education*, 52, 617–623doi:10.1016/j.compedu.2008.11.004.
- Muppala, J. K., & Kong, C. K. (2007). Podcasting and its use in enhancing course content. In *Proceedings of the 10th IASTED international conference on computer and advanced technology in education* (pp. 492–495). Beijing, China: ACTA Press.
- Ogawa, M., & Nickels, D. (2006). Improving students' perceptions in large-enrollment courses through podcasting. In T. Reeves, & S. Yamashita (Eds.), *Proceedings of world conference on E-learning in corporate, government, healthcare, and higher education* (pp. 250–254). Chesapeake, VA: AACE.
- Ralph, J., & Olsen, S. (2007). Podcasting as an educational building block in academic libraries. *Australian Academic & Research Libraries*, 38(4), 270–280.
- Richardson, W. (2006). *Blogs, wikis, podcasts, and other powerful web tools for classrooms*. Thousand Oaks, CA: Corwin Press.
- Richardson, W. (2008). *Blogs, wikis, podcasts, and other powerful web tools for classrooms* (2nd ed.). Thousand Oaks, CA: Corwin Press.
- Shim, J., Shropshire, J., Park, S., Harris, H., & Campbell, N. (2006). Perceived value of podcasting: student communication-medium preferences. In *Proceedings of the 12th Americas conference on information systems* (pp. 2186–2194). Acapulco, Mexico.
- Siemens, G. (2004). *Connectivism: A learning theory for the digital age*. Retrieved from <http://www.elearnspace.org/Articles/connectivism.htm>.
- Soloman, G., & Schrum, L. (2007). *Web. 2.0: New tools, new schools*. Eugene, OR: International Society for Technology in Education.
- Tynan, B., & Colbran, S. (2006). Podcasting, student learning and expectations. In *Proceedings of (ASCLITE) the 23rd annual conference of the Australian society for computers in learning in tertiary education* (pp. 825–832). Sidney, Australia.
- Vogt, M., Scaffner, B., Ribar, A., & Chavez, R. (2010). The impact of podcasting on the learning and satisfaction of undergraduate nursing students. *Nursing in Practice*, 10(1), 38–42.